(12) UK Patent Application (19) GB (11) 2 320 463 (13) A

(43) Date of A Publication 24.06.1998

(21) Application No 9726877.5

(22) Date of Filing 19.12.1997

(30) Priority Data
(31) 19653911 (32) 21.12.1996 (33) DE

(71) Applicant(s)
MAN Roland Druckmaschinen Aktiengesellschaft
(Incorporated in the Federal Republic of Germany)
Postfach 101264, D-63012 Offenbach, Federal Republic of Germany

Coatec GmbH
(Incorporated in the Federal Republic of Germany)
Breitenbacher Strasse 40, D-36381, Schlüchtern, Federal Republic of Germany

(72) Inventor(s)
Martin Endisch
Gerhard Johner

(51) INT CL^6
B41F 31/26

(52) UK CL (Edition P)
B6C CERJ

(56) Documents Cited
US 5660109 A US 5233921 A

(58) Field of Search
UK CL (Edition P) B6C CERJ
INT CL^6 B41F 31/26
ONLINE DATABASES:WPI

(74) Agent and/or Address for Service
Haseltine Lake & Co
Imperial House, 15-19 Kingsway, LONDON, WC2B 6UD, United Kingdom

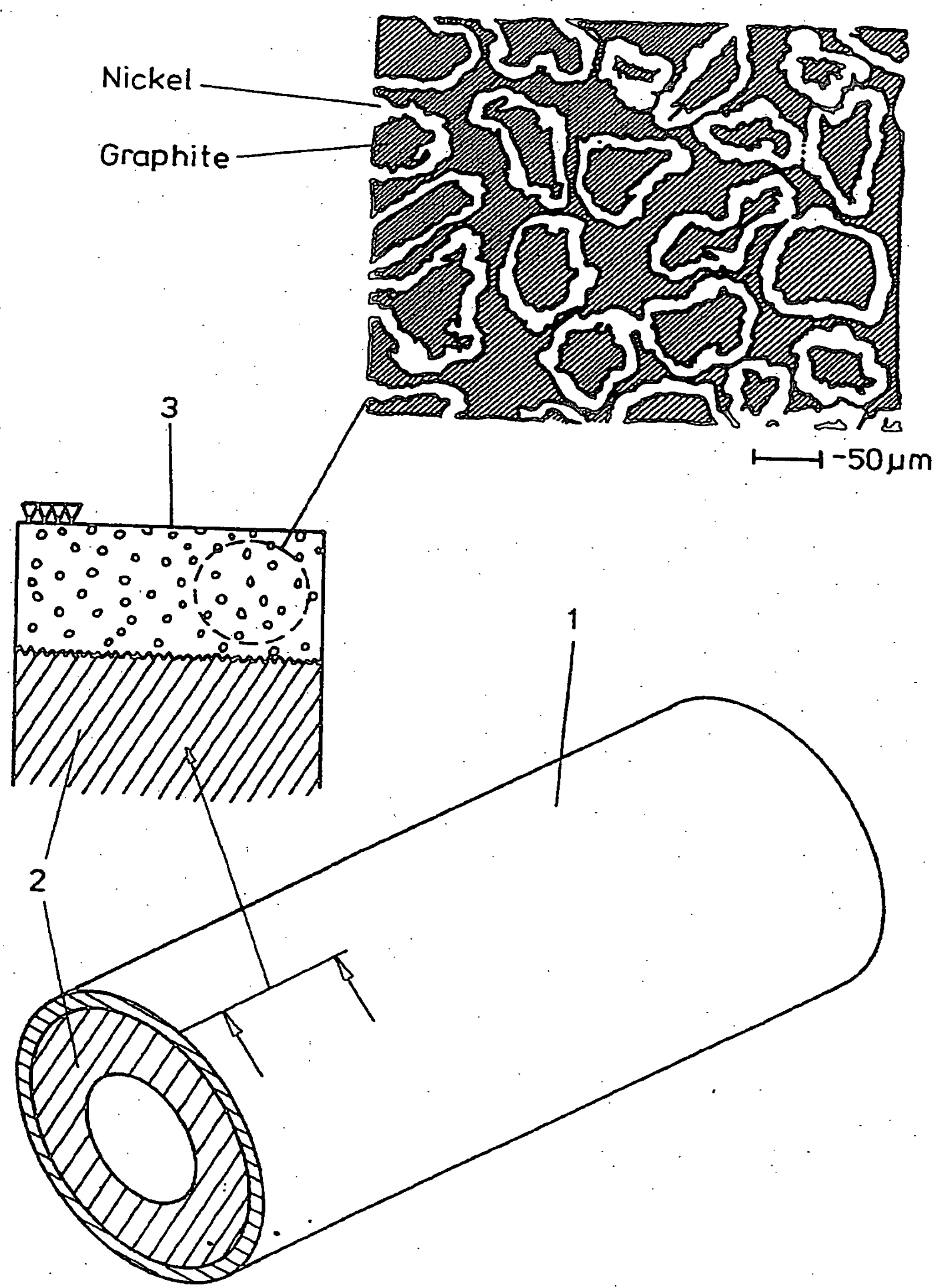
(54) Printing machine roller having an ink-receptive coating

(57) An ink distributor roller has a coating 3 over the whole rolling surface which consists of a support matrix made of a metal which has good heat conductivity and wear-resistance, such as nickel or aluminium-silicon alloy, and graphite or plastics particles, e.g. of polyester, incorporated into the metal matrix.

The coating is produced by thermal spraying, preferably plasma spraying or flame spraying. The residual porosity of the coating can be varied within wide limits according to the process. This residual porosity also provides the possibility of varying the hydrophobic property within wide limits by applying a sealing layer of an ink-receptive plastic. The roughness of layers of this type can be adapted practically in any way at all to the requirements of the particular offset process.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 320 463 A


Nickel
Graphite
3
-50µm
1
2

Hr58412

2320463

Printing machine roller having an ink-receptive coating

The invention relates to a printing machine roller, in particular an ink roller, preferably for offset machines. Such rollers have an ink-receptive or hydrophobic coating on a roller core or body. For instance, in an offset machine a continuous roller is used as an ink distributor cylinder, being provided on its surface with a coating.

In various areas of plant technology there is a need for surfaces which have to be capable of being easily wetted with oils, mineral oil and composite mineral oil materials such as offset inks, for instance. Moreover, these surfaces have to be extremely water-repellent as otherwise there is a risk of tearing or separation of the ink film - so-called blank running.

In an offset printing machine the purpose of the ink unit is to transfer the thinnest possible, uniformly sealed ink film to the printing plate cylinder. In modern printing machines the ink is transported by means of a complex roller system. Starting with an ink fountain in which the amount of ink is controlled in zones by means of so-called ink blades which are set against an ink ductor roller, ink is further transported into the ink unit via a so-called ink vibrator or directly by means of an intermediate roller. The ink unit itself comprises several rollers which on the one hand take care of transverse distribution and in the end have the job of supplying the ink rollers in direct contact with the printing plate with the necessary amount of ink. As the rheological properties of the ink are of crucial importance for the printing process, in modern printing machines several ink rollers are tempered, i.e.

subjected to a temperature control mechanism, with the object of keeping the ink within a temperature range favourable for offset processes. Only in this way can the ink partition processes between two ink rollers be controlled. These ink partition processes are necessary to ensure the desired division of the available amount of ink into ink which is to be transported on and ink to be transported back, i.e. left on the roller. According to current prior art the ink units are essentially constructed from combinations of rollers, comprising a rubber roller and a polyamide roller. A widely known trade name for the polyamide layers of these rollers is Rilsan. These Rilsan coatings are generally produced in thicknesses of 0.3 mm to 1.0 mm.

Unfortunately, this material has heat conductivity values in the range of from 0.22 to 0.25 W/mK. This very poor heat conductivity severely limits the effect of the internal tempering, e.g. by water cooling or heating, as regards the ink film on the roller. The information absolutely vital for the temperature control system, namely the ink film temperature, is therefore transmitted to the tempering medium for the most part very late and greatly attenuated because of the good heat insulation of the Rilsan layer. The control speed and accuracy of the system is thus greatly restricted.

In the more recent past this fact has proved to be problematic not only in fast-running rotary machines but in particular also in the case of offset machines operated without water, the so-called Toray machines. In fast-running rotary machines the heating of the ink film in the inking unit, triggered by the flexing and friction action of the pairs of rollers with respect to each other, is extremely high as a result of the high dynamic effect, so that a stable process at high speeds

would be absolutely unthinkable without extensive internal cooling. In spite of these structural measures the inks also have to be matched so that, in a similar way to a motor oil, they possess a viscosity range which can be used in the offset technology field. If special inks are used, that do not possess a wide viscosity range of this type, extensive ink partition problems occur in fast rotary machines since the rheological properties are no longer suitable for offset. Such difficulties may be ink lifting, inadequate ink density, tendency to over-emulsification, ink movement etc.

In offset machines operated without water (Toray) the temperature constancy of the ink film has an even greater significance. The ink film has to be kept within the temperature range of 30° ± 2° C. At the present time this aim cannot be satisfactorily achieved with Rilsan-coated ink distributors. Only very greatly reduced web speeds are possible at present, especially in rotary machines in which the Toray process is to be carried out. The capacity of the machines is therefore greatly restricted.

The aim of the invention is, therefore, to find an ink-receptive coating for printing machine rollers, especially ink rollers, which is comparable to Rilsan and which, in addition, possesses an excellent heat conductivity and, moreover, good resistance to wear, which cannot be achieved with copper layers used previously.

This aim is achieved with the invention by giving the core a coating made of a metallic matrix incorporating graphite-like particles.

US-PS 2 908 068 discloses the coating of ink transfer rollers with thickly applied (0.6 mm or more) porous materials such as stainless steel, tungsten and molybdenum by means of the Schoop process. The Schoop

process is the original form of thermal spraying and was developed at about the turn of the century. The only thing that the flame spraying technology of that time has in common with modern plasma spraying is the overall idea of thermal spraying. Furthermore, it is known nowadays that the ink-receptive properties of the described materials, set out in US-PS 2 908 068, are not correct. On the contrary, these materials are water-receptive by virtue of the application of passive layers such as Cr_2O_3 on stainless steel. In the case of molybdenum layers a boundary angle of about 54° was determined in laboratory tests with respect to distilled water. This value is even lower than that for Cr_2O_3 layers, which are characterised by boundary angles of about 70° in the case of distilled water, and implies an even better wettability for water or aqueous solutions. This property is given by passivating layers of the MoO_3 type. Tests with layers of this type in ink roller application in printing machines had also promptly led to blank running problems. This means that the ink-receptivity of Mo layers cannot be reliably provided without further steps. The wear-reducing effect of Mo layers is known from countless applications, in particular from Otto engine construction.

Experimental tests have shown that the corrosion-resistant effect of porous layers described in US-PS 2 908 068 according to the Schoop process is not present since it is an open porosity, which after a certain time makes contact possible between corrosively acting components of the offset inks and the non-corrosion-resistant basic roller material.

In accordance with the described temperature problem in ink transfer rollers in offset machines and the known weakness of on the one hand copper layers with respect to their wear behaviour and their chemical

resistance, and on the other hand molybdenum layers with respect to the blank running problem, the invention makes use of the good heat conductivity, ink-receptivity and chemical resistance of graphite in a metal matrix, e.g. of nickel. Layers made of materials of this type have been known for years as sealing layers in compressor parts of aero gas turbines or generally as sliding bearing materials with very good emergency operation properties. The latter application naturally implies ink receptivity, since the main component of offset inks is mineral oil. A sliding bearing material which would have poor wettability for mineral oil could scarcely be considered suitable.

Graphite is known as a dry lubricant, the reason for this property being the easy mobility of the individual lattice planes of the hexagonal lattice. The lattice consists of very stable layer planes which are joined together by only weak bonds. This layer structure is the reason for the distinctive anisotropy of the physical properties. Thus the heat conductivity parallel to the layer is approximately 330 W/mK and thus corresponds to the heat conductivity of copper. Perpendicular thereto it drops to about 2% of this value. Layers of graphite in a nickel matrix are mainly produced by thermal spraying or sinter processes. Because graphite particles with a nickel casing having a particle diameter which varies between 5 μm and 150 μm are present in layers of this type in a spatially completely disordered arrangement, anisotropy of the physical properties is restored. With a weight content of the nickel matrix with respect to the graphite contained therein that varies between ratios of 55:45 to 95: 5, a mean heat conductivity of between about 120 W/mK to 75 W/mK is achieved. The nickel matrix is necessary as a support matrix since the wear properties of pure graphite are unsatisfactory for

offset applications.

Comparable property profiles for offset applications can also be achieved with other composite materials such as, for instance, polyester particles in an aluminium-silicon support matrix. In a case like this the heat conductivity is ensured by the matrix material aluminium-silicon, and the ink receptivity by polyester particles. Moreover, because of the high heat effect with thermal spraying, part of the polyester is graphitised to form graphite so that again similar sliding properties, and hence wear resistance, are achieved as in the case of the sliding bearing material nickel/graphite. Aluminium-silicon/polyester is also preferably processed by thermal spraying or sintering to form layers. A residual porosity of the layer is common to both layer systems - nickel/graphite and aluminium-silicon/polyester - and this can be limited by the coating parameters within wide boundaries of between about 40 vol% and 4 vol%. This residual porosity offers the possibility of a pore-closing seal with the aid of an ink-receptive plastic sealant so that this property can be adapted to the individual application in offset machines. Coatings on printing machine rollers, in particular ink rollers, can be produced from these materials in thicknesses of 30 μm to 1.5 mm with the process described. However, as regards the best possible heat conductivity a layer thickness of 0.1 to 0.15 mm has proved satisfactory.

The single Figure shows, in a greatly schematic way, the structure of an ink roller 1 whose roller core 2 is covered with a coating 3 over the entire rolling surface.

The coating 3 of the invention should preferably be ground to give a surface a roughness of $R_z \approx 8 - 12\ \mu m$. It may be advantageous, according to the application required, to change this roughness.

The coating 3 of the invention can be polished easily down to roughnesses of $R_z \approx 3.0\mu m$ and can be prepared with practically any roughness in the upwards direction.

A coating of this type affords an extraordinarily good stability of the ink film, even in extreme offset conditions (very low ink take-up, large free surfaces), so that the dreaded blank running of the ink rollers no longer occurs.

The coating of the invention is preferably applied by thermal spraying, in particular plasma spraying or flame spraying. Other processes potentially suitable for producing the coating 3 are PVD, CVD, plasma-aided CVD, the galvanic process with dispersive incorporation, sintering process, hot isostatic pressing and all reactive processes with which the coating of the invention is produced by separation from two liquid or gas phases.

Claims

1. A roller for a printing machine, having a roller core and an ink-receptive coating on the rolling surface of the core, characterised in that the ink-receptive coating (3) is in the form of a porous metallic support layer with graphite-like particles incorporated therein.

2. A roller according to claim 1, in which the coating (3) is sealed with a pore-sealing, ink-receptive plastic.

3. A roller according to claim 1 or 2, in which the metal support layer is a nickel matrix and the particles are of graphite.

4. A roller according to claim 1 or 2, in which the metal support layer is an aluminium-silicon matrix and the particles are of graphitised polyester.

5. A roller according to any preceding claim, in which the coating (3) is applied by thermal spraying, preferably by plasma spraying or by flame spraying.

6. A roller according to any preceding claim, in which the coating (3) has a thickness of 0.03 mm to 1.5 mm, preferably about 0.1 mm.

7. A roller according to any preceding claim, in which the coating (3) has a surface roughness $R_z \leq 10$ μm, preferably about 8 μm.

8. A roller according to any preceding claim, in which the coating (3) is a PVD layer (Physical Vapour Deposition), with simultaneous deposition of the support layer and the particles.

9. A roller according to any of claims 1 to 7, in which the coating (3) is a CVD layer (Chemical Vapour Deposition).

10. A roller according to any of claims 1 to 7, in which the coating (3) is a plasma-CVD layer (plasma-aided CVD).

11. A roller according to any of claims 1 to 7, in which the coating (3) is applied electrolytically, with simultaneous dispersive deposition of graphite or polyester or comparable plastics.

12. A roller according to any of claims 1 to 7, in which the coating (3) is applied by sintering.

13. A roller according to any of claims 1 to 7, in which the coating (3) is applied by hot isostatic pressing (Hippen process).

14. A roller according to any of claims 1 to 7, in which the coating (3) is applied by a reactive process in which the coating (3) is produced by reactive conversion from either two liquid phases or two gas phases.

15. A roller according to any preceding claim, in which the surface of the coating (3) is smoothed after the coating procedure, in particular by grinding and polishing.

16. An ink distributor cylinder constituted by a roller according to any preceding claim.

17. A roller substantially as described herein with reference to the accompanying drawings.

18. A process for making an ink-receptive roller, by applying a hydrophobic coating to a cylinder, the coating consisting of a metallic matrix incorporating low-friction temperature-resistant particles.

The Patent Office

Application No:	GB 9726877.5	**Examiner:**	A J Rudge
Claims searched:	1-18	**Date of search:**	26 February 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B6C(CERJ)

Int Cl (Ed.6): B41F-031/26

Other: Online : WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5660109 (Constantino)	
A	US 5233921 (MAN Roland)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.